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IS : 9000 ( Part XXXI ) - 1978

# *Indian Standard*

## BASIC ENVIRONMENTAL TESTING PROCEDURES FOR ELECTRONIC AND ELECTRICAL ITEMS

### PART XXXI COMBINED COLD/LOW AIR PRESSURE TESTS

UDC 621.31 + 621.38.038 : 620.193



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INDIAN STANDARDS INSTITUTION  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

Price Rs. 5.00

Gr 3

August 1978

## Indian Standard

### BASIC ENVIRONMENTAL TESTING PROCEDURES FOR ELECTRONIC AND ELECTRICAL ITEMS

#### PART XXXI COMBINED COLD/LOW AIR PRESSURE TESTS

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## *Indian Standard*

# BASIC ENVIRONMENTAL TESTING PROCEDURES FOR ELECTRONIC AND ELECTRICAL ITEMS

## **PART XXXI COMBINED COLD/LOW AIR PRESSURE TESTS**

### **0. FOREWORD**

**0.1** This Indian Standard ( Part XXXI ) was adopted by the Indian Standards Institution on 19 May 1978, after the draft finalized by the Environmental Testing Procedures Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

**0.2** This standard ( Part XXXI ) deals with combined cold ( with gradual change of temperature ) and low air pressure tests for both heat dissipating and non-heat dissipating items.

**0.2.1** The object of the test is to determine the ability of components or equipment or other articles to be stored and used under a simultaneous combination of low temperature and low air pressure.

**0.2.2** This combined test should normally be used only if the effects of combined environments will not be revealed by subjecting the item to single environments. The procedures given in this standard are limited to the case of items which achieve temperature stability during the test procedure.

**0.2.3** In the case of testing heat dissipating items, this procedure applies only to the testing of one item at a time. This test is applicable to airborne items and also to those used on ground at high altitudes.

**0.3** The test procedure applies to air pressure down to about 1 kPa. At air pressures below 1 kPa, phenomena not taken into account in the design of this test procedure become important.

**0.3.1** The relationship between altitude, pressure and temperature, has not been indicated in this standard. Such data should be obtained from special standards.

**0.4** The application of tests for non-heat dissipating items instead of tests for heat dissipating items should follow the guidelines given in IS : 9000 ( Part II )-1977\*.

**0.4.1** Heat dissipating items should preferably be tested with no forced air circulation as in the case of cold testing.

NOTE — The maximum over temperature ( 5°C ) of the hottest point of the surface of the item acceptable for considering an item non-heat dissipating as given in the definition of a heat dissipating item in IS : 9000 ( Part I )-1977† shall be related to measurement at normal air pressure and temperature.

**0.5** This standard is based on IEC Publication 68-2-40( 1976 ) 'Basic environmental testing procedures, Part 2 : Tests, Test Z/AM : Combined cold/low air pressure tests', issued by the International Electrotechnical Commission.

**0.6** This standard should be read in conjunction with the following:

IS : 9000 ( Part I )-1977 Basic environmental testing procedures for electronic and electrical items: Part I General

IS : 9000 ( Part II )-1977 Basic environmental testing procedures for electronic and electrical items: Part II Cold test

IS : 9000 ( Part XIII )-19....Basic environmental testing procedures for electronic and electrical items: Part XIII Air pressure test ( *under preparation* )

IS : 9001 ( Part II )-1978 Guidance for environmental testing: Part II Cold and dry heat tests

**0.7** In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960‡.

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## **1. SCOPE**

**1.1** This standard ( Part XXXI ) is intended to provide a standard test procedure to determine the suitability of electronic/electrical items for use and/or storage under a combination of low temperature and low air pressure.

**1.1.1** This test is primarily intended for equipment type items.

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\*Basic environmental testing procedures for electronic and electrical items: Part II Cold test,

†Basic environmental testing procedures for electronic and electrical items: Part I General,

‡Rules for rounding off numerical values ( *revised* ).

## 2. TERMINOLOGY

**2.1** For the purpose of this standard, the definitions and explanation of terms given in IS : 9000 ( Part I )-1977\* shall apply.

## 3. OBJECT

**3.1** The object of this standard is to determine the ability of components or equipment or other articles to be stored and used under a simultaneous combination of low temperature and low air pressure.

## 4. GENERAL DESCRIPTION

**4.1** This test is a combination of cold and low air pressure tests. The item is first subjected to the appropriate severity of cold as indicated in the relevant specification. In the case of operational tests, a check is then made to ensure that the item is capable of operation. With the temperature maintained at the indicated value, the chamber air pressure is then reduced to the appropriate severity as specified in the relevant specification. These conditions are maintained for the specified duration.

## 5. DESCRIPTION OF TEST APPARATUS

**5.1 Test Chamber** — The chamber shall be capable of maintaining the conditions specified for cold test ( for non-heat dissipating item or for heat dissipating item ) and for low air pressure tests. The requirement for the chamber wall temperature does not apply during periods of temperature or pressure change.

Care shall be taken to avoid air contamination by ancillary equipment and devices and by the air introduced when pressure is restored to normal.

**5.2 Mounting** — For the testing of heat dissipating item, the mounting of the test item shall comply with the requirements of IS : 9000 ( Part II )-1977†.

## 6. SEVERITIES

### 6.1 General

**6.1.1** A severity for the purpose of this test is defined as a combination of temperature, air pressure and duration of exposure and shall correspond to one of the combinations chosen from **5.2**.

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\*Basic environmental testing procedures for electronic and electrical items: Part I General.

†Basic environmental testing procedures for electronic and electrical items: Part II Cold test.

**6.1.2** The temperature and low air pressure values, tolerances and durations shall comply with those given in cold test and low air pressure tests.

NOTE — It is appreciated that at air pressures below 10 kPa, the tolerances given in cold test might be difficult to attain. Wider tolerances may in this case be prescribed by the relevant specification.

**6.1.3** The duration of exposure shall be measured from the time when temperature stability of the item has been reached under conditions of low air pressure.

**6.2** The severities for this test shall be chosen from the following combinations:

<i>Temperature</i>	<i>Air Pressure</i>	<i>Duration</i>
—55°C	4·4 kPa	2 h
—25°C	4·4 kPa	2 h
—55°C	7·2 kPa	2 h
—25°C	7·2 kPa	2 h
—55°C	11·5 kPa	2 h
—25°C	11·5 kPa	2 h
—55°C	15 kPa	2 h
—55°C	30 kPa	2 h*
—40°C	30 kPa	2 h*
—25°C	30 kPa	2 h*
—55°C	46·5 kPa	2 h
—25°C	46·5 kPa	2 h
—40°C	53·3 kPa	2 h*
—25°C	53·3 kPa	2 h*
—40°C	60 kPa	2 h*
—25°C	60 kPa	2 h*
—40°C	70 kPa	2 h*
—25°C	70 kPa	2 h*

NOTE — 1 kPa = 10 mbar.

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\*If necessary the relevant specification may stipulate a duration of 4 hours or 16 hours.

## 7. PRECONDITIONING

7.1 The relevant specification may call for preconditioning.

## 8. INITIAL MEASUREMENTS

8.1 The item shall be visually inspected and electrically and mechanically checked as required by the relevant specification.

## 9. CONDITIONING

### 9.1 General

9.1.1 *Heat Dissipating Items* — These shall preferably be tested without forced air circulation in the chamber according to Section 4 of IS : 9000 ( Part II )-1977\*. When the chamber used for testing is large enough to meet the conditions specified in Section 4 of IS : 9000 ( Part II ) 1977\*, but cooling of the chamber can only be carried out by forced air circulation, Method A may be applied.

9.1.2 *Non-heat Dissipating Items* — These may be tested in a chamber with or without forced air circulation according to Section 3 of IS : 9000 ( Part II )-1977\*.

### 9.2 Procedure for Heat Dissipating Item Without Artificial Cooling of the Item and for Non-heat Dissipating Item

9.2.1 The chamber shall be at the temperature of the laboratory. The item while being at the standard atmospheric condition for testing shall be introduced into the chamber in the unpacked, switched off, 'ready for use' state, in its normal position or as otherwise specified.

9.2.2 The temperature within the chamber shall be adjusted to the temperature appropriate to the severity. The item shall be allowed to reach temperature stability.

The rate of change of temperature within the chamber shall not exceed 1°C per minute, averaged over a period of not more than 5 minutes.

The test temperature shall be measured as specified in 2.1.2 of IS : 9000 ( Part I )-1977†.

9.2.3 The item shall be switched on and checked to ascertain whether it is capable of functioning in accordance with the relevant specification.

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\*Basic environmental testing procedures for electronic and electrical items: Part II  
Cold test.

†Basic environmental testing procedures for electronic and electrical items: Part I  
General.

The item shall then be switched off and allowed to reach temperature stability.

**NOTE 1** — Equipment normally operated throughout the flight shall be operated from the start of the temperature conditioning and shall continue to operate throughout the test.

**NOTE 2** — Equipment operated intermittently in flight shall be operated only when the required conditioning has been attained and the equipment has achieved a stable temperature.

**9.2.4** The pressure within the chamber shall then be reduced to the value appropriate to the severity. The rate of change of pressure shall not exceed 10 kPa per minute.

**9.2.5** The items shall be switched on or be electrically loaded. Checks shall be made to ascertain whether the item is capable of functioning in accordance with the relevant specification. The items may remain in the operating condition or be switched off as prescribed by the relevant specification.

**9.2.6** If required by the relevant specification, intermediate measurements shall be made during the final hour of low air pressure period in accordance with **10**.

**9.2.7** The conditions of temperature and pressure shall be maintained for the specified duration.

**9.2.8** If required, the operation of the equipment shall be stopped during the temperature/low air pressure conditioning phase, until the internal temperature of the equipment has restabilized so that a subsequent cold switch-on or start-up can be made.

**9.2.9** The item shall then be switched off or unloaded.

**9.2.10** The chamber pressure shall be restored to normal at a rate not exceeding 10 kPa per minute. During the increase of pressure, temperature control is not required. The item shall remain in the chamber and the temperature shall be gradually raised to a value lying within the limits of standard atmospheric conditions for testing. The rate of change of the temperature within the chamber shall not exceed 1°C per minute averaged over a period of not more than 5 minutes.

**9.2.11** The item shall then be subjected to the recovery procedure in the chamber or otherwise as appropriate.

**9.3 Precautions When Testing Items with Artificial Cooling —**  
The precautions when testing item with artificial cooling are the same as given in IS : 9000 ( Part II )-1977\*.

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\*Basic environmental testing procedures for electronic and electrical items: Part II  
Cold test.

## 10. INTERMEDIATE MEASUREMENTS

**10.1** The relevant specification may call for loading and/or measurements during or at the end of conditioning while the item is still in the chamber. If such measurements are required, the relevant specification shall define the measurements and the period or period after which they shall be carried out. For these measurements, the item shall not be removed from the chamber.

NOTE — Measurements preceded by recovery, which would require removal and reintroduction of the items into the chamber, are not permissible during the conditioning.

If it is desired to know the performance of the type of item before the end of the prescribed duration, one additional lot will be required for each specified duration. Recovery and final measurements shall be performed separately for each lot.

## 11. RECOVERY

**11.1** To remove droplets of water, the item may be shaken by hand or a blast of air at laboratory temperature may be applied for a short duration.

**11.2** The item shall then remain under standard recovery conditions for a period adequate for the attainment of temperature stability, with a minimum of one hour.

When several items are tested simultaneously and where 1 hour recovery period is inadequate the maximum period for recovery shall be 2 hours and all measurements shall be completed at the end of this period.

**11.3** If required by the relevant specification, the item shall be switched on or loaded and measured continuously during the recovery period.

## 12. FINAL MEASUREMENTS

**12.1** The item shall be visually examined and electrically and mechanically checked as required by the relevant specification.

## 13. INFORMATION TO BE GIVEN IN THE RELEVANT SPECIFICATION

**13.1** When this test is included in the relevant specification, the following details shall be given as far as they are applicable:

- Preconditioning;
- Initial measurements;
- Details of mounting or supports ( applicable to heat dissipating items );

- d) State of item including cooling system;
- e) Severity: temperature, pressure and duration of exposure;
- f) Checks to be made at low temperature before reducing the air pressure;
- g) Checks, measurements, and/or loading during the cold/low air pressure conditioning;
- h) Loading and measurements during recovery;
- j) Final measurements; and
- k) Any deviation in procedure as agreed upon between the purchaser and the manufacturer.